

Unit Planning Guide: Grade Algebra 2 Unit 2 of 4

Unit Title: Polynomials and Rational Expressions	Pacing (Duration of Unit): 10 weeks
Grade: Algebra 2	Buffer Day(s):

Desired Results

Transfer Goals (Priority practice standards in **bold**)

Students will be able to independently use their learning to:

- MP.1. Make sense of problems and persevere in solving them.
- MP.2. Reason abstractly and quantitatively.
- MP.3. Construct viable arguments and critique the reasoning of others.
- MP.4. **Model with mathematics.**
- MP.5. Use appropriate tools strategically.
- MP.6. Attend to precision.
- MP.7. **Look for and make use of structure.**
- MP.8. Look for and express regularity in repeated reasoning.

Established Goals (2011 MA Curriculum Frameworks Standards Incorporating the Common Core State Standards)

Prerequisite Standards:

-
-
-

WIDA for English Language Learners

Standard 1: ELLs **communicate** for **Social** and **Instructional** purposes within the school setting

Standard 3: ELLs **communicate** information, ideas and concepts necessary for academic success in the content area of **Mathematics**

Unit Planning Guide: Grade Algebra 2 Unit 2 of 4

Standards (Priority Standards in **bold**):

- **F.IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* ★
- **F.BF.3** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*
- **F.BF.4.** Find inverse functions.
 - **F.BF.4a.** Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or $f(x) = (x + 1)/(x - 1)$ for $x \neq 1$.*
- **F.IF.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over specified interval. Estimate the rate of change from a graph. ★
- **F.IF.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★
 - **F.IF.7b.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. ★
 - **F.IF.7c.** Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. ★
 - **F.IF.7e.** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. ★
- **A.SSE. 3.** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
 - **A.SSE. 3a.** Factor a quadratic expression to reveal the zeros of the function it defines.
 - **A.SSE. 3b.** Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. Use the properties of exponents to transform expressions for exponential functions. For example, the expression $1.15t$ can be rewritten as $(1.151/12)^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.
- **A.APR.6** Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.

In the lesson planning stage, teachers will need to differentiate lessons for ELLs. In order to accomplish this they will need: 1.) this curriculum map, 2.) a list of their ELLs and their proficiency levels, and 3.) appropriate language function expectations and scaffolds or supports.

★ indicates Modeling standard.

Unit Planning Guide: Grade Algebra 2 Unit 2 of 4

Meaning (*Mostly assessed through Performance Tasks/Assessments)

Big Ideas: (Statements and concepts written in teacher friendly language which reflect the important [but not obvious] generalizations we want students to be able to arrive at. These are used by the teacher to focus daily instruction.)

- Functions are abstract relationships that model the Real Number System
- Geometric transformations affect and depend upon the domain and range
- Key features of those representations provide clues to both interpreting and building mathematical models.

Essential Questions: (Questions which frame ongoing and important inquiries about the big ideas. They are written for students and used in daily instruction to help engage students in meaningful thinking.)

- What do models of algebraic relationships tell us?
- What is the power of using functions/ equations to model real-world relationships?
- Why do some mathematical models have limitations in real-world situations?

Acquisition (*Mostly assessed through traditional summative assessments)

Knowledge: Key basic concepts, facts, and key terms (written in phrases) students should be able to recall independently.

Students will know ...

- Functions are number representations of algebraic relationships, thus can be operated upon.
- Functions are defined by their domain, which affect how they can be combined through arithmetic or composition.
- Each function has an inverse, but each inverse is not a function.
- A function and its inverse are a reflection upon the $y = x$ line.
- Composing a function with its inverse will result in the identity.
- Functions can be composed if the range of the input function is in the domain of the output function.
- Vertical asymptotes are created when a domain value is rendered undefined.
- Characteristics of a field and what gives a field closure
- Polynomial functions are closed under addition, subtraction and multiplication.
- Polynomial functions are not closed under division.

Skills: The discrete skills and process students should be able to use independently.

Students will be skilled at:

- Adding, subtracting and multiplying functions symbolically, tabularly and geometrically (graphically). *Evaluating*
- Identifying the domain and range of functions. *Analyzing*
- Computing the inverse and verifying the inverse by composing the functions. *Applying*
- Geometrically (graphically) determine the inverse of a function by reflection. *Analyzing*
- Performing composition of functions *Evaluating*
- Predicting the graph of a function based on the transformation performed *Analyzing*

Unit Planning Guide: Grade Algebra 2 Unit 2 of 4

- When we are operating on functions, we are operating on the range values.
- Function transformation can be achieved by adding, subtracting and multiplying domain or range values.

Key Academic Vocabulary

- Composition
- Inverse of a function
- Domain
- Range
- Asymptotes
- Field
- Closure
- End behavior
- Periodicity
- Intervals
- Piece-wise functions
- Logarithms

Resource Suggestions:

Unit Planning Guide: Grade Algebra 2 Unit 2 of 4

--